

# Balloon Fuel Cell Power System



*Scientific balloon.*

NASA Lewis Research Center's Electrochemical Technology Branch has teamed with the NASA Wallops Flight Facility to demonstrate the operation of a hydrogen-oxygen proton exchange membrane (PEM) fuel cell for application in the upper atmosphere. NASA Wallops' Balloon Programs Branch has a requirement for a high-power, long-duration power system for use on a scientific balloon platform. The current power system will not meet these needs. The objective of this program is to deliver a 200-W (minimum) fuel cell system that can deliver approximately 10 kWh of electrical energy.

The Lewis team is responsible for designing, building, testing, and delivering a flight power system capable of meeting mission requirements. This power system will be based on a hydrogen/oxygen fuel cell developed as a result of a NASA Lewis Phase II Small Business Innovation Research (SBIR) PEM fuel cell program with ElectroChem, Inc.

The remote system must deliver power continuously, in a safe, reliable manner. It must be able to accommodate extreme ambient conditions, including a temperature range of -70 to 100 °F and a pressure range of 14.7 to below 1 psia. Waste heat, which is normally rejected by fuel cell systems, will be used to maintain proper operating temperatures for the fuel cell and the accompanying ancillary components, including the electronic equipment. It will also be used to maintain the temperature of the product water and to aid

in proper water storage and/or discharge.

In addition to the extreme environmental conditions, the fuel cell power system must be able to withstand the physical forces and accelerations that will be encountered over the course of the mission. These forces are expected to reach as high as 8 to 10g. The initial flight is scheduled for early Summer 1997, and pending successful operation, the system will be reused on subsequent experimental balloon flights. The next planned program phase is to scale-up the fuel cell power system to 96 kWh of electrical output.